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# EPIDEMIOLOGICAL DATA FOR MALARIA CONTROL ACTIVITIES

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Medical Division
Malaria Control in War Areas
U. S. Public Health Service
Atlanta, Georgia
July, 1945

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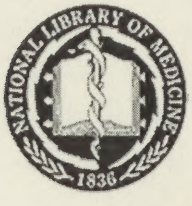

# Epidemiological Data For Malaria Control Activities

Malaria in the United States of America is a disease of apparent decreasing importance. Graph A illustrates this point. It shows that for all States which report deaths and cases of malaria, there has been a steady downward trend during the last 24 years, despite two cyclic increases one in the late 20's and the other in the early 30's. Table I shows a decrease in the country-wide mortality rate from 5.8 per 100,000 population in 1920 to 0.5 per 100,000 population in 1943. Table II likewise shows a decrease in the country-wide morbidity rate from 336.5 per 100,000 population in 1920 to 40.7 per 100,000 population in 1943. Thus 1943 became the year of lowest rates in the history of malaria in this country.

Although malaria appears to be of decreasing importance as a public health problem in this country there are two reasons why malaria control operations must still be carried on: 1) Malaria is traditionally an endemic disease in the Southeastern States which as a unit show mortality and morbidity rates of 2 to 3 times the rates for the country; and 2) The cyclic character exhibited by the epidemic curve of malaria suggests that in spite of the consistent downward trend of the last ten years the time may yet come when the disease will sharply increase in another cycle. Carriers returning from abroad after service with the armed forces may provide the impetus which will give rise to another upswing in the epidemic curve. For these reasons considerable emphasis is being given by the Office of Malaria Control in War Areas toward maintaining efforts directed at decreasing the hazard from malaria in the endemic areas of the Southeast.

In considering choice of areas for control operations it has been the policy of MCWA to concentrate on the most important counties as determined by death rates. It is generally considered that reporting of deaths due to malaria is more reliable than the reporting of cases, although glaring examples of the respective faults of either are not difficult to demonstrate.

Using mortality rates as the criterion, Map I illustrates the endemic malaria regions of the Southeast. The most important malarious areas, that is, the counties with the highest death rates, are to be found in 13 States. These are: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee and Texas.

Graph B illustrates that the mortality and morbidity reported from these 13 States has declined during the past 24 years in a manner

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similar to that of the country as a whole and also has shown comparable cyclic variations. Table III shows that the mortality rate in the 13 States dropped from 13.6 per 100,000 population in 1920 to 1.4 per 100,000 population in 1943. Table IV shows that the morbidity rate in the 13 States dropped from 982.7 per 100,000 population in 1920 to 128.8 per 100,000 population in 1943.

Residual spraying of houses with DDT during the fiscal year 1945 was carried on in 113 counties in these 13 States plus 3 demonstration projects in two additional states. The present 113 counties do not provide adequate coverage in relation to the total number of malarious counties, but represent the maximum coverage with present allocations of DDT. Next season the number of counties should be increased.

Table V shows the distribution of 1321 counties in 13 States according to the average annual malaria mortality rates* for the period 1938-1942 inclusive. It is noted that 188 counties recorded a rate of 10 or more per 100,000 population; that 649 counties showed a rate of 0.1-9; and 484 counties reported no deaths. This table viewed in connection with Map I would suggest that counties with death rates of 10 or more per 100,000 population represent in general the cores of the endemic foci of the Southeast. They would therefore appear to be the areas around which major control activities should be directed.

Table VI shows the relative concentration of the malaria problem, as represented by mortality data for this period among the counties with rates of 10 or more per 100,000 population. It is noted that in 7 of the 13 States more than 50% of the deaths were reported from these counties. In the remaining 6 States there is less focalized concentration of deaths.

Table VII shows the number of rural homes in the 188 counties reporting malaria mortality rates of 10 or more per 100,000 population during the period 1938-1942. These figures were taken from the Bureau of the Census tabulation of housing in 1940 and represent all rural homes, including those in towns of less than 2500 population.

The second portion of Table VII shows in column (3) the number of counties that reported malaria deaths with rates of less than 10 per 100,000. To obtain the number of cases estimated to occur in these counties (and hence the additional number of houses needed to spray) the average number of deaths reported annually is multiplied by the arbitrary figure 400. This figure is selected as a reasonable estimate of the number of cases per death. The results of this calculation are listed in column (4).

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* These rates are tentative and are based on State Health Department and Bureau of the Census reports of deaths.

Column (5) is an addition of columns (2) and (4) and represents the proposed number of homes for residual spray to be allocated to each State under an "ideal program".

Column (6) shows the percentage that each State's total is to the total for all 13 States.

Table VIII shows the "goodness of fit" of allocations actually made for the fiscal year 1945 as related to allocations which would have been made under the system to be followed hereafter.

It is immediately apparent that certain states have been allocated projects far in excess of the relative importance of their malaria problem as measured in terms of malaria mortality. In approving projects for the fiscal year 1946, and thereafter, every effort will be made to readjust allocations to states towards equalization of the program in terms of the percentages listed in Table VII, Column 6.

For the remainder of the calendar year 1945 sufficient DDT is available to spray approximately 385,000 homes. However, because of operational cut-backs, some states will be unable to complete the total sprayings allotted them for the remainder of the 1945 malaria season. DDT thus accrued may be transferred to other states where operational facilities permit the spraying of additional homes.

For the calendar year 1946 DDT will be available to spray 550,000 homes. This will permit a considerable expansion of activities for the 1946 malaria season in all 13 states except Kentucky and Missouri. Allocations to the latter two states cannot be increased until equalized with other states. Table IX, column 5 shows the increase allowable in each state.

In summary, the following policies will be adopted in regard to approval of projects for fiscal year 1946 in order to attain the objectives outlined in the preceding paragraphs:

1. For the remainder of the 1945 malaria season each state will have a ceiling of houses to be sprayed in regular projects. The ceiling for each state is listed in Table IX column 3 with the exception of certain emergency flood control projects already approved. Provision also exists for moderately increasing the 1945 malaria season ceiling in some of those states where operational schedules permit the spraying of additional homes in the latter part of the season. Such increase may approach, but not exceed, the 1946 malaria season ceiling (Table IX, column 4.)

2. For the 1946 season allocations of DDT will be available to spray 550,000 homes and a small additional reserve will be held for

special emergency allocation by the Atlanta office. During this period each state may expect project approvals not to exceed the ceilings listed in Table IX column 4. However, because Kentucky and Missouri have already had projects approved in fiscal year 1945 in excess of the proposed ceilings, the ceilings for these states will be set at the same figures as for 1945 (Kentucky, 13,875 and Missouri 26,862). This excess will be met from the reserve mentioned above.

3. Project proposals currently being submitted for the fiscal year 1946 will be approved up to the ceilings listed in Table IX Column 3. Supplementary proposals may be submitted for operations beginning January 1, 1946 and approval of them may be expected up to the ceilings listed in Table IX column 4. If possible the latter ceilings will be increased at a later date.

4. According to information available to the Medical Division of MCWA the 188 counties listed with average annual mortality rates of 10 or more per 100,000 population represent the most important foci of endemic malaria. Work in all or parts of rural areas of these counties - up to the ceilings mentioned - will be approved by this Division. It is recognized, however, that mortality data on a county-wide basis do not necessarily focalize the malaria problem sufficiently accurately for practical operational purposes. Projects submitted for operations in counties not included in this list will be approved on the basis of additional epidemiological justification submitted by the States with the project proposal. Such written justification will hereafter be required for all projects outside of these 188 counties.

In this connection it should be pointed out that when work was initiated in the spring of 1945, some projects were approved initially on a county-wide basis in spite of the fact that the malaria hazard varied widely in different portions of the county. Frequently such approvals therefore incorporated local areas and houses where the malaria mosquito hazard was absent or negligible. With continued operation of the program, it is suggested that entomological reconnaissance be established as an integral part of project operations. This should result in refinement in selection of intra-county areas where protection is indicated. Such procedure has been followed in several states. Others are urged to re-assess accordingly.

5. The Medical Division MCWA would like to encourage premise residual spraying, where practicable, of homes from which blood film verified cases or carriers of malaria have been reported. Spraying of such premises is pre-approved within the limits of the ceilings mentioned.

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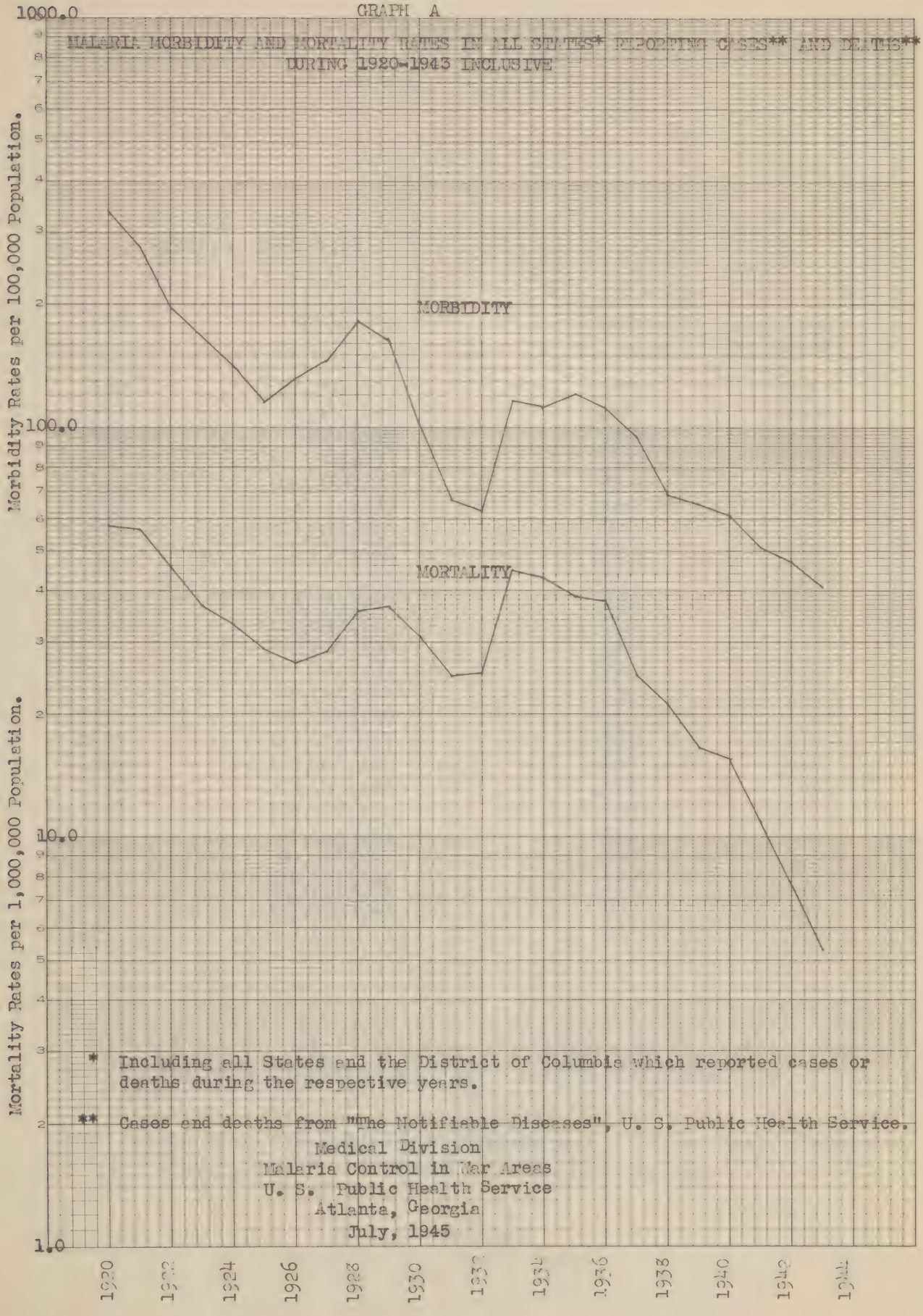
GRAPH A




* Including all States and the District of Columbia which reported cases or deaths during the respective years.

** Cases and deaths from "The Notifiable Diseases", U. S. Public Health Service.

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Table I

Malaria Mortality in The "Total United States" *

| Year | Population ** | Deaths *** | Rate Per 100,000 |
|---|---|---|---|
| 1920 | 67,232,703 | 3873 | 5.8 |
| 1921 | 91,346,045 | 5121 | 5.6 |
| 1922 | 96,262,140 | 4402 | 4.6 |
| 1923 | 104,803,038 | 3848 | 3.7 |
| 1924 | 101,328,774 | 3345 | 3.3 |
| 1925 | 103,340,137 | 2978 | 2.9 |
| 1926 | 101,319,008 | 2696 | 2.7 |
| 1927 | 104,695,564 | 2968 | 2.8 |
| 1928 | 120,501,115 | 4291 | 3.6 |
| 1929 | 113,546,267 | 4146 | 3.6 |
| 1930 | 110,431,214 | 3428 | 3.1 |
| 1931 | 106,625,506 | 2649 | 2.5 |
| 1932 | 106,768,887 | 2688 | 2.5 |
| 1933 | 100,084,751 | 4471 | 4.5 |
| 1934 | 102,306,559 | 4401 | 4.3 |
| 1935 | 111,284,067 | 4310 | 3.9 |
| 1936 | 103,515,422 | 3897 | 3.8 |
| 1937 | 108,713,285 | 2700 | 2.5 |
| 1938 | 109,470,134 | 2307 | 2.1 |
| 1939 | 106,445,883 | 1750 | 1.6 |
| 1940 | 90,550,504 | 1393 | 1.5 |
| 1941 | 107,131,604 | 1165 | 1.1 |
| 1942 | 110,614,314 | 842 | .8 |
| 1943 | 115,883,607 | 617 | .5 |

* "Total United States" includes only those states reporting malaria deaths. The number so reporting varied during this period from 27 to 37 states.

** Populations from the Bureau of the Census.

*** Deaths from "The Notifiable Diseases", U.S. Public Health Service. Total deaths each year vary somewhat from final reports of either the States or the Bureau of the Census.

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Table II

Malaria Morbidity in the "Total United States" *

| Year | Population** | Cases*** | Rate Per 100,000 |
|---|---|---|---|
| 1920 | 54,730,668 | 184,163 | 336.5 |
| 1921 | 68,559,162 | 189,630 | 276.6 |
| 1922 | 80,572,395 | 157,221 | 195.1 |
| 1923 | 83,106,140 | 139,090 | 167.4 |
| 1924 | 78,914,693 | 111,632 | 141.5 |
| 1925 | 86,514,161 | 100,416 | 116.1 |
| 1926 | 88,355,474 | 115,999 | 131.3 |
| 1927 | 96,573,880 | 140,651 | 145.6 |
| 1928 | 92,225,175 | 166,521 | 180.6 |
| 1929 | 101,104,997 | 164,030 | 162.2 |
| 1930 | 96,147,749 | 98,481 | 102.4 |
| 1931 | 105,465,741 | 70,353 | 66.7 |
| 1932 | 109,505,964 | 68,613 | 62.7 |
| 1933 | 107,049,125 | 125,549 | 117.3 |
| 1934 | 115,970,296 | 133,222 | 114.9 |
| 1935 | 114,563,500 | 137,502 | 120.0 |
| 1936 | 119,490,310 | 132,928 | 111.2 |
| 1937 | 114,256,059 | 107,583 | 94.2 |
| 1938 | 123,461,594 | 84,206 | 68.2 |
| 1939 | 126,755,375 | 82,655 | 65.2 |
| 1940 | 127,841,038 | 78,130 | 61.1 |
| 1941 | 129,736,070 | 67,053 | 51.7 |
| 1942 | 127,871,598 | 60,071 | 47.0 |
| 1943 | 133,966,319 | 54,555 | 40.7 |

* "Total United States" includes only those states reporting malaria cases. The number so reporting varied during this period from 25 to 49 states.

** Populations from the Bureau of the Census.

*** Cases from "The Notifiable Diseases", U.S.Public Health Service

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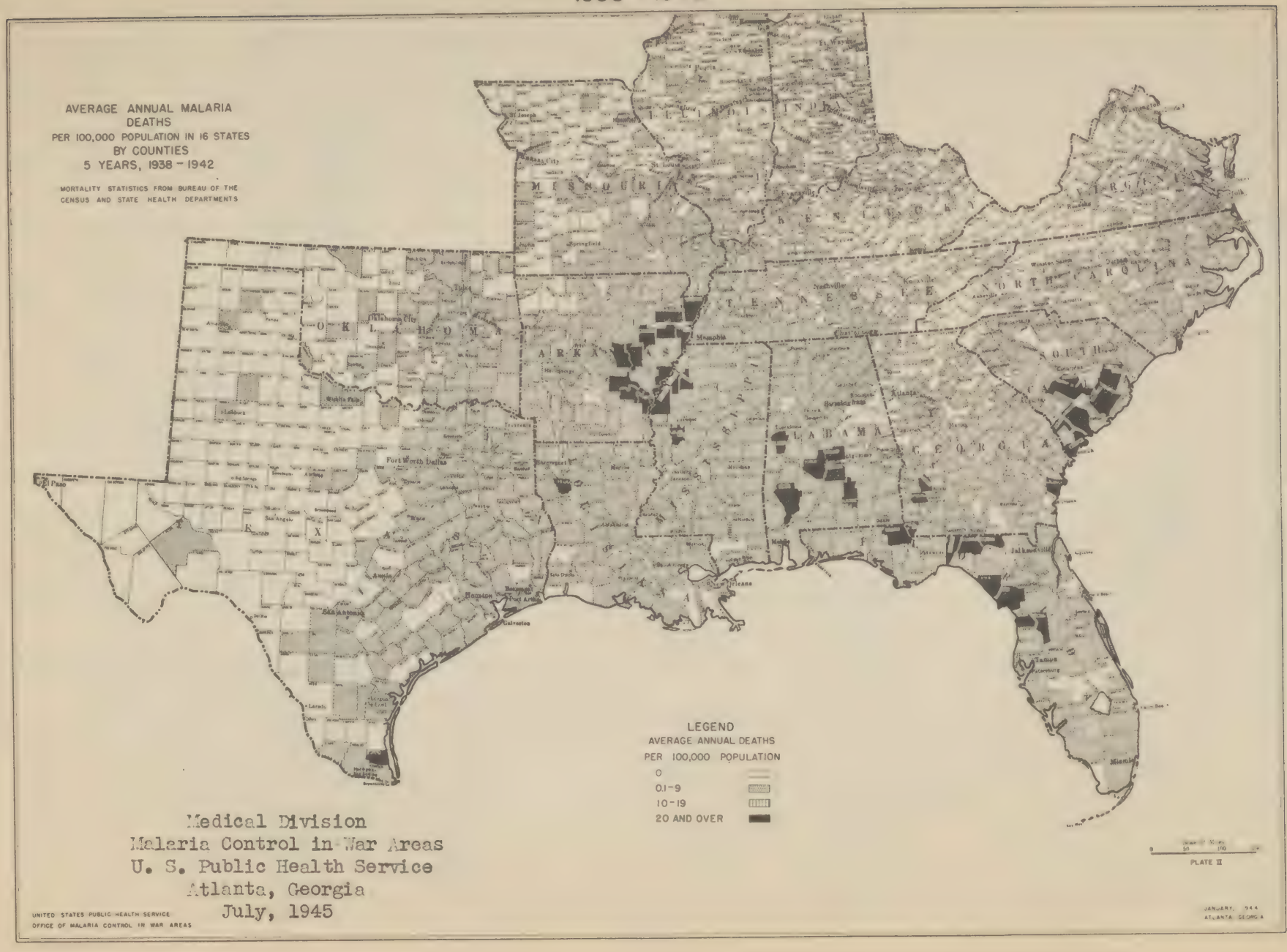
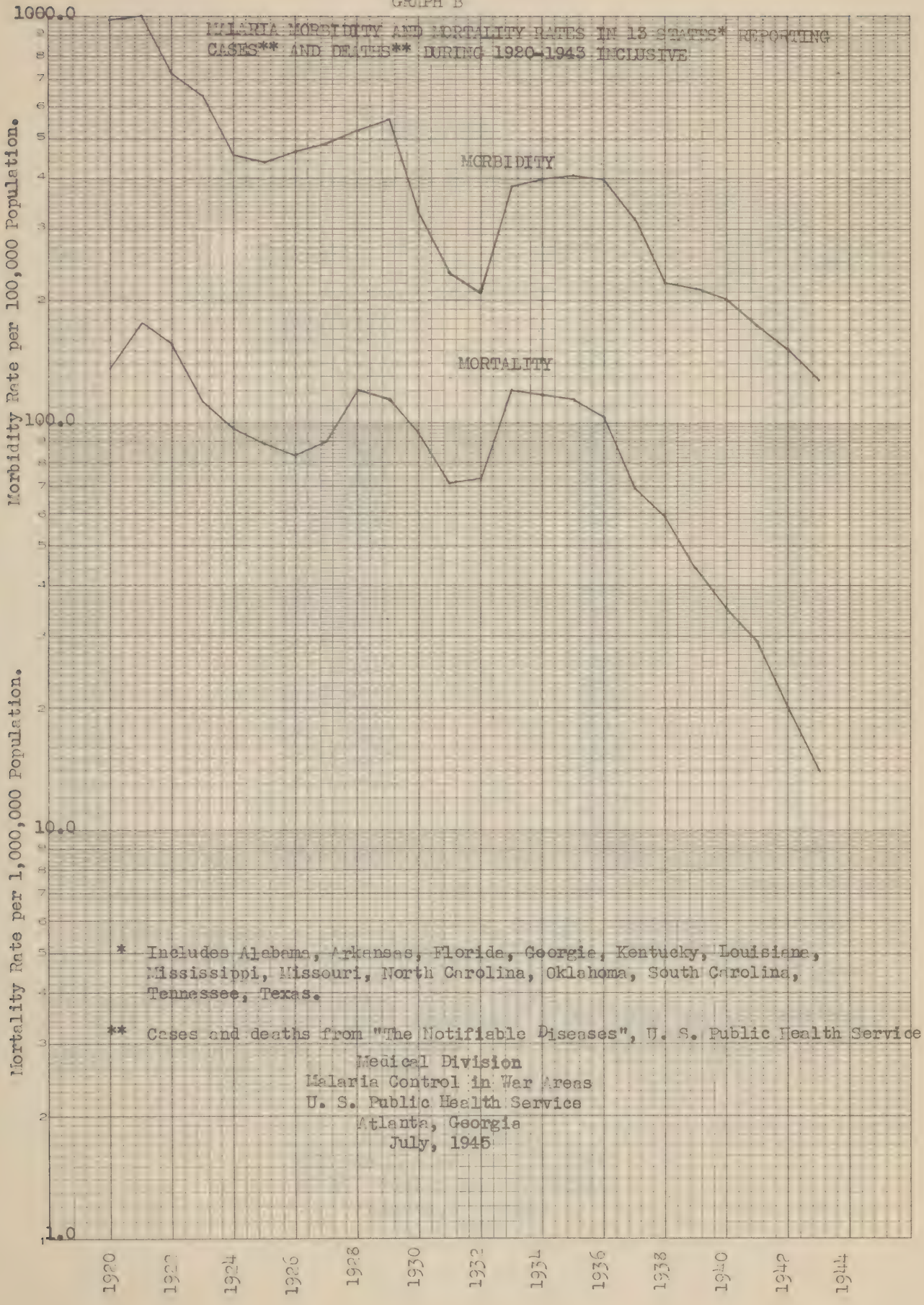
MAP I

# MALARIA DEATHS PER 100,000 POPULATION
## 1938 – 1942



GRAPH B




* Includes Alabama, Arkansas, Floride, Georgie, Kentucky, Louisiane, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas.

** Cases and deaths from "The Notifiable Diseases", U. S. Public Health Service

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Table III

Malaria Mortality in 13 Southern States *

| Year | Population ** | Deaths *** | Mortality Rate per 100,000 |
|---|---|---|---|
| 1920 | 26,693,768 | 3622 | 13.6 |
| 1921 | 27,912,787 | 4850 | 17.4 |
| 1922 | 26,764,921 | 4142 | 15.5 |
| 1923 | 32,153,671 | 3619 | 11.2 |
| 1924 | 32,675,071 | 3138 | 9.6 |
| 1925 | 31,396,072 | 2789 | 8.9 |
| 1926 | 30,748,344 | 2551 | 8.3 |
| 1927 | 31,247,665 | 2825 | 9.0 |
| 1928 | 34,499,839 | 4135 | 12.0 |
| 1929 | 34,765,293 | 3967 | 11.4 |
| 1930 | 35,041,406 | 3281 | 9.4 |
| 1931 | 35,356,331 | 2515 | 7.1 |
| 1932 | 35,669,432 | 2590 | 7.3 |
| 1933 | 35,985,280 | 4334 | 12.0 |
| 1934 | 36,302,066 | 4256 | 11.7 |
| 1935 | 36,553,016 | 4155 | 11.4 |
| 1936 | 36,753,872 | 3774 | 10.3 |
| 1937 | 37,008,228 | 2554 | 6.9 |
| 1938 | 37,371,408 | 2192 | 5.9 |
| 1939 | 37,827,407 | 1653 | 4.4 |
| 1940 | 38,119,978 | 1327 | 3.5 |
| 1941 | 38,811,695 | 1119 | 2.9 |
| 1942 | 39,084,011 | 784 | 2.0 |
| 1943 | 39,321,268 | 565 | 1.4 |

* Includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. From 11 to 13 of these states reported each year.

** Populations from the Bureau of the Census.

*** Deaths from "The Notifiable Diseases", U. S. Public Health Service. Total deaths each year vary somewhat from final totals from the states or from the Bureau of the Census.

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Table IV

Malaria Morbidity in 13 Southern States *

| Year | Population ** | Cases *** | Morbidity Rate per 100,000 |
|---|---|---|---|
| 1920 | 18,026,038 | 177,150 | 982.7 |
| 1921 | 18,348,952 | 183,551 | 1000.3 |
| 1922 | 21,018,618 | 151,823 | 722.3 |
| 1923 | 20,994,389 | 134,546 | 640.9 |
| 1924 | 23,805,562 | 108,641 | 456.4 |
| 1925 | 22,454,810 | 98,043 | 436.6 |
| 1926 | 24,557,177 | 113,793 | 463.4 |
| 1927 | 28,559,922 | 138,346 | 484.4 |
| 1928 | 31,417,459 | 164,494 | 523.6 |
| 1929 | 29,026,301 | 162,148 | 558.6 |
| 1930 | 29,252,183 | 96,520 | 330.0 |
| 1931 | 29,516,647 | 68,815 | 233.1 |
| 1932 | 32,404,516 | 67,793 | 209.2 |
| 1933 | 32,666,903 | 124,471 | 381.0 |
| 1934 | 32,942,790 | 131,648 | 399.6 |
| 1935 | 33,172,789 | 134,968 | 406.9 |
| 1936 | 33,353,347 | 132,376 | 396,9 |
| 1937 | 33,576,129 | 106,470 | 317.1 |
| 1938 | 37,371,408 | 82,919 | 221.9 |
| 1939 | 37,827,407 | 81,258 | 214.8 |
| 1940 | 38,119,978 | 77,027 | 202.1 |
| 1941 | 38,811,695 | 67,302 | 173.4 |
| 1942 | 39,084,011 | 59,421 | 152.0 |
| 1943 | 39,321,268 | 50,640 | 128.8 |

* Includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. From 8 to 13 states reported each year.

** Populations from the Bureau of the Census.

*** Cases from "The Notifiable Diseases", U. S. Public Health Service.

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Table V

Distribution of All Counties, by States, According to Average Annual Mortality Rates* per 100,000 Population, 1938-42

| State | Number of Counties | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Average annual mortality rate per 100,000 | | | | | | | | Total |
| | 0 | 0.1-4 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30&over | Counties |
| Alabama | 6 | 28 | 14 | 11 | 2 | 4 | - | 2 | 67 |
| Arkansas | 6 | 16 | 21 | 13 | 8 | 10 | - | 1 | 75 |
| Florida | 6 | 22 | 14 | 10 | 7 | 2 | 2 | 4 | 67 |
| Georgia | 46 | 58 | 22 | 22 | 7 | 3 | - | 1 | 159 |
| Kentucky | 82 | 34 | 2 | 1 | 1 | - | - | - | 120 |
| Louisiana | 5 | 33 | 17 | 5 | 3 | 1 | - | - | 64 |
| Mississippi | 3 | 33 | 26 | 12 | 4 | 2 | 1 | 1 | 82 |
| Missouri | 66 | 40 | 4 | 3 | 2 | - | - | - | 115 |
| North Carolina | 47 | 42 | 7 | 4 | - | - | - | - | 100 |
| Oklahoma | 32 | 35 | 8 | 1 | 1 | - | - | - | 77 |
| South Carolina | 5 | 18 | 8 | 4 | 4 | 1 | 2 | 4 | 46 |
| Tennessee | 40 | 38 | 13 | 2 | 2 | - | - | - | 95 |
| Texas | 140 | 71 | 25 | 13 | 4 | - | - | 1 | 254 |
| Total Counties | 484 | 468 | 181 | 101 | 45 | 23 | 5 | 14 | 1321 |
| Cumulative total | 1321 | 837 | 369 | 188 | 87 | 42 | 19 | 14 | |

* These rates are tentative and are based on State Health Department and Bureau of the Census reports of deaths.

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Table VI

Distribution Of Counties By States According To Deaths and Death Rates Per 100,000 Population
1938-1942

| State | Counties Reporting Malaria Deaths | Counties with death rate of 10 or more per 100,000 | Per Cent of Counties with rate of 10 or more | Total Deaths | Deaths in Counties with rate of 10 or more | % of Deaths in Counties with rate of 10 or more |
|---|---|---|---|---|---|---|
| Alabama | 61 | 19 | 31.1 | 845 | 478 | 56.6 |
| Arkansas | 69 | 32 | 46.4 | 1088 | 823 | 75.6 |
| Florida | 61 | 25 | 41.0 | 504 | 304 | 60.3 |
| Georgia | 113 | 33 | 29.2 | 590 | 308 | 52.2 |
| Kentucky | 38 | 2 | 5.3 | 106 | 18 | 17.0 |
| Louisiana | 59 | 9 | 15.3 | 520 | 160 | 30.8 |
| Mississippi | 79 | 20 | 25.3 | 911 | 534 | 58.6 |
| Missouri | 49 | 5 | 10.2 | 230 | 129 | 56.1 |
| North Carolina | 53 | 4 | 7.5 | 254 | 62 | 24.4 |
| Oklahoma | 45 | 2 | 4.4 | 239 | 51 | 21.3 |
| South Carolina | 41 | 15 | 36.6 | 732 | 506 | 69.1 |
| Tennessee | 55 | 4 | 7.3 | 347 | 73 | 21.0 |
| Texas | 114 | 18 | 15.8 | 851 | 390 | 45.8 |
| Total | 837 | 188 | 22.5 | 7217 | 3836 | 53.2 |

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Table VII

Number of counties necessary to operate in, and number of homes necessary to spray to (1) give county-wide coverage in counties reporting in 1938 - 1942 an average of 10 or more deaths from malaria per 100,000 population, and (2) to spray estimated homes in which malaria is reported in remaining counties. *

| State | Counties with rates of 10 or more per 100,000 pop. | | Counties with rates of 0.1 - 9 per 100,000 pop. | | Total Homes | % of Total |
|---|---|---|---|---|---|---|
| | No. Counties (1) | No. Homes** (2) | No. Counties (3) | No. Homes* (4) | (5) | (6) |
| Alabama | 19 | 118833 | 42 | 29280 | 148113 | 12.06 |
| Arkansas | 32 | 198298 | 37 | 21200 | 219498 | 17.88 |
| Florida | 25 | 70627 | 36 | 16000 | 86627 | 7.06 |
| Georgia | 33 | 93732 | 80 | 22560 | 116292 | 9.47 |
| Kentucky | 2 | 5711 | 36 | 7040 | 12751 | 1.04 |
| Louisiana | 9 | 48309 | 50 | 28800 | 77109 | 6.28 |
| Mississippi | 20 | 144308 | 59 | 30160 | 174468 | 14.21 |
| Missouri | 5 | 37182 | 44 | 8080 | 45262 | 3.69 |
| N. C. | 4 | 18779 | 49 | 15360 | 34139 | 2.78 |
| Oklahoma | 2 | 13758 | 43 | 15040 | 28798 | 2.34 |
| S. C. | 15 | 85810 | 26 | 18080 | 103890 | 8.46 |
| Tennessee | 4 | 20451 | 51 | 21920 | 42371 | 3.45 |
| Texas | 18 | 101627 | 96 | 36880 | 138507 | 11.28 |
| Total | 188 | 957425 | 649 | 270400 | 1227825 | 100.00 |

* No. Homes = 400 x average number of deaths reported annually

** From Bureau of Census volume on Housing, 1940. Total includes homes in towns of less than 2500 population

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Table VIII

"Goodness of fit" of allocations for 1945.

Number of home sprayings allocated for 1945 and number which would have been allocated in each state under proposed system.

| State | Number homes allocated under arbitrary plan* | Estimated No. Homes actually approved 1945 | Excess | Deficit |
|---|---|---|---|---|
| Alabama | 44108 | 24980 | | 19128 |
| Arkansas | 69126 | 74617 | 5491 | |
| Florida | 27289 | 31083 | 3794 | |
| Georgia | 36603 | 23324 | | 13279 |
| Kentucky | 4003 | 13875 | 9872 | |
| Louisiana | 24517 | 12000 | | 12517 |
| Mississippi | 55231 | 67926 | 12695 | |
| Missouri | 14241 | 26862 | 12621 | |
| N. C. | 10738 | 3500 | | 7238 |
| Oklahoma | 9083 | 7100 | | 1983 |
| S. C. | 32715 | 38755 | 6040 | |
| Tennessee | 13356 | 13096 | | 260 |
| Texas | 43877 | 47769 | 3892 | |
| Total | 384887 | 384887 | 54405 | 54405 |

* State totals obtained by multiplying 384,887 by percentages listed in column (6) of Table II.

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Table IX

Distribution of 550,000 Houses Among 13 States According to Relative Malaria Problem as Measured by Mortality Statistics.

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| State | % (from Table VII Col. 6) | Ceiling for 1st half Fiscal year 1946 | Ceiling for last half fiscal year 1946 | Increase |
| Alabama | 12.06 | 24980 | 66330 | 41350 |
| Arkansas | 17.88 | 74617 | 98340 | 23723 |
| Florida | 7.06 | 31083 | 38830 | 7747 |
| Georgia | 9.47 | 23324 | 52085 | 28761 |
| Kentucky | 1.04 | 13875 | 5720* | None |
| Louisiana | 6.28 | 12000 | 34540 | 22540 |
| Mississippi | 14.21 | 67926 | 78155 | 10229 |
| Missouri | 3.69 | 26862 | 20295** | None |
| N. C. | 2.78 | 3500 | 15290 | 11790 |
| Oklahoma | 2.34 | 7100 | 12870 | 5770 |
| S. C. | 8.46 | 38755 | 46530 | 7775 |
| Tennessee | 3.45 | 13096 | 18975 | 5879 |
| Texas | 11.28 | 47769 | 62040 | 14271 |
| | 100.00 | 384887 | 550000 | |

* Kentucky will be approved for a ceiling of 13,875 for last half of fiscal year 1946.

** Missouri will be approved for a ceiling of 26,862 for last half of fiscal year 1946.

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TABLE X

COUNTIES IN SOUTHEAST HAVING AN AVERAGE ANNUAL MALARIA DEATH RATE OF 10 OR MORE PER 100,000 POPULATION DURING 5 YEAR PERIOD 1938-42. SHOWING RANK ORDER, EXTENDED MALARIA CONTROL IN 1945 AND RURAL DWELLINGS

| Rank Order in State | County | Average Annual Death Rate | Rank Order in S.E. States | Extended Malaria Control YES | Extended Malaria Control NO | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | | ALABAMA | | | |
| 1. | Green | 35.4 | 4 | X | | 5099 |
| 2. | Lowndes | 34.4 | 5 | X | | 5776 |
| 3. | Autauga | 22.9 | 26 | X | | 4660 |
| 4. | Dallas | 20.6 | 37 | X | | 8988 |
| 5. | Clarke | 20.3 | 41 | | - | 6713 |
| 6. | Crenshaw | 20.3 | 42 | | - | 6074 |
| 7. | Sumter | 16.8 | 68 | | - | 6918 |
| 8. | Bullock | 16.2 | 74 | | - | 4053 |
| 9. | Washington | 14.8 | 90 | | - | 3754 |
| 10. | Baldwin | 13.6 | 105 | | - | 8901 |
| 11. | Montgomery | 13.5 | 109 | X | | 8243 |
| 12. | Wilcox | 12.9 | 123 | | - | 6355 |
| 13. | Lamar | 12.2 | 141 | | - | 4717 |
| 14. | Monroe | 12.2 | 143 | | - | 7001 |
| 15. | Perry | 12.0 | 147 | | - | 6389 |
| 16. | Elmore | 11.0 | 165 | | - | 7575 |
| 17. | Hale | 11.0 | 166 | | - | 6340 |
| 18. | Bibb | 10.9 | 167 | | - | 5037 |
| 19. | Geneva | 10.3 | 185 | | - | 6240 |
| | | | | | | 118833 |
| 20. | (Marengo) | 9.5 | 198 | X | | |
| | | | ARKANSAS | | | |
| 1. | Lincoln | 32.5 | 9 | X | | 5134 |
| 2. | Crittendon | 24.0 | 21 | X | | 11417 |
| 3. | Woodruff | 23.5 | 23 | X | | 5424 |
| 4. | Jefferson | 22.7 | 27 | X | | 12257 |
| 5. | Cross | 22.3 | 29 | X | | 5523 |
| 6. | Poinsett | 22.3 | 30 | X | | 7494 |
| 7. | Prairie | 22.2 | 31 | X | | 3889 |
| 8. | Phillips | 21.8 | 33 | X | | 9099 |
| 9. | Lonoke | 21.5 | 34 | X | | 8381 |
| 10. | Desha | 21.4 | 35 | X | | 6270 |
| 11. | Mississippi | 21.4 | 36 | X | | 17227 |
| 12. | Drew | 18.2 | 55 | X | | 4116 |
| 13. | Lee | 17.9 | 56 | X | | 5618 |
| 14. | Little River | 17.6 | 59 | X | | 4413 |
| 15. | Randolph | 17.5 | 61 | | - | 3822 |
| 16. | Conway | 16.7 | 69 | | - | 3968 |
| 17. | Lafayette | 16.6 | 71 | | - | 4551 |

TABLE X (Con't)

| Rank Order in State | County | Average Annual Death Rate | Rank Order in S.E. States | Extended Malaria Control YES | Extended Malaria Control NO | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | (Ark. con't) | | | | |
| 18. | St. Francis | 16.6 | 72 | X | | 8062 |
| 19. | Bradley | 15.5 | 80 | | - | 3866 |
| 20. | Howard | 14.4 | 95 | | - | 3620 |
| 21. | Miller | 14.4 | 96 | | - | 5294 |
| 22. | Yell | 14.3 | 98 | | - | 5354 |
| 23. | Monroe | 14.2 | 99 | X | | 3786 |
| 24. | Hempstead | 12.8 | 126 | | - | 6211 |
| 25. | Craighead | 12.3 | 138 | | - | 8511 |
| 26. | Ouachita | 12.2 | 144 | | - | 5496 |
| 27. | Jackson | 12.1 | 145 | | - | 5430 |
| 28. | Ashley | 11.9 | 148 | | - | 5757 |
| 29. | Sevier | 11.8 | 152 | | - | 3095 |
| 30. | Clay | 10.6 | 175 | | - | 7167 |
| 31. | Lawrence | 10.6 | 177 | | - | 5623 |
| 32. | Calhoun | 10.4 | 183 | | - | 2423 |
| 35. | (Arkansas) | 9.0 | 224 | X | | 198298 |
| 44. | (Chicot) | 7.3 | 279 | X | | |
| | | F L O R I D A | | | | |
| 1. | Dixie | 57.0 | 1 | X | | 1965 |
| 2. | Levy | 31.9 | 10 | X | | 3569 |
| 3. | Jackson | 30.8 | 12 | X | | 7273 |
| 4. | Sumter | 30.8 | 13 | X | | 3034 |
| 5. | Jefferson | 28.3 | 16 | X | | 3067 |
| 6. | Hamilton | 26.6 | 19 | | - | 2594 |
| 7. | Madison | 24.7 | 20 | X | | 3541 |
| 8. | Citrus | 20.5 | 38 | X | | 1912 |
| 9. | Suwanee | 17.6 | 60 | X | | 3522 |
| 10. | Taylor | 17.3 | 62 | X | | 2630 |
| 11. | Calhoun | 17.0 | 65 | | - | 2092 |
| 12. | Franklin | 16.7 | 70 | | - | 1054 |
| 13. | Liberty | 16.0 | 76 | | - | 954 |
| 14. | Holmes | 15.5 | 81 | | - | 3575 |
| 15. | Hendry | 15.3 | 83 | | - | 1864 |
| 16. | Wakulla | 14.6 | 93 | | - | 1444 |
| 17. | Gilchrist | 14.1 | 100 | | - | 1087 |
| 18. | Walton | 14.0 | 102 | | - | 2860 |
| 19. | Columbia | 11.9 | 149 | | - | 2973 |
| 20. | Gulf | 11.5 | 157 | | - | 2051 |
| 21. | Washington | 11.4 | 159 | | - | 3153 |
| 22. | Okaloosa | 10.9 | 168 | | - | 3628 |
| 23. | Gadsden | 10.8 | 169 | | - | 5146 |
| 24. | Leon | 10.7 | 173 | X | | 3877 |
| 25. | Hernando | 10.6 | 176 | | - | 1762 |
| | | | | | | 70627 |

TABLE X (Con't)

| Rank Order in State | County | Average Annual Death Rate | Rank Order in S.E. States | Extended Malaria Control YES | Extended Malaria Control NO | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | | G E O R G I A | | | |
| 1. | McIntosh | 30.2 | 14 | | - | 1588 |
| 2. | Seminole | 23.6 | 22 | X | | 1983 |
| 3. | Calhoun | 23.0 | 25 | X | | 2903 |
| 4. | Terrell | 20.4 | 39 | X | | 3257 |
| 5. | Long | 19.6 | 44 | | - | 1006 |
| 6. | Toombs | 18.9 | 51 | | - | 2760 |
| 7. | Pulaski | 18.3 | 54 | | - | 1754 |
| 8. | Clay | 17.0 | 66 | | - | 1874 |
| 9. | Crawford | 16.8 | 67 | | - | 1693 |
| 10. | Screven | 15.7 | 79 | X | | 4511 |
| 11. | Lee | 15.3 | 85 | X | | 2295 |
| 12. | Crisp | 14.8 | 89 | X | | 2394 |
| 13. | Wayne | 13.7 | 103 | | - | 2535 |
| 14. | Baker | 13.6 | 104 | X* | | 1796 |
| 15. | Camden | 13.5 | 107 | | - | 1690 |
| 16. | Echols | 13.5 | 108 | | - | 859 |
| 17. | Telfair | 13.2 | 114 | | - | 3692 |
| 18. | Washington | 13.2 | 115 | | - | 5232 |
| 19. | Laurens | 13.1 | 117 | | - | 6171 |
| 20. | Turner | 12.9 | 122 | | - | 2864 |
| 21. | Early | 12.8 | 125 | | - | 3762 |
| 22. | Bryan | 12.7 | 129 | | - | 1494 |
| 23. | Webster | 12.7 | 131 | | - | 1095 |
| 24. | Wilcox | 12.5 | 134 | | - | 3087 |
| 25. | Ben Hill | 12.4 | 135 | | - | 1635 |
| 26. | Houston | 12.4 | 137 | | - | 2974 |
| 27. | Decatur | 11.7 | 153 | | - | 3864 |
| 28. | Johnston | 10.8 | 170 | | - | 3127 |
| 29. | Tift | 10.8 | 171 | | - | 3289 |
| 30. | Burke | 10.6 | 174 | X | | 6428 |
| 31. | Dodge | 10.5 | 181 | | - | 4161 |
| 32. | Treutlen | 10.5 | 182 | | - | 1750 |
| 33. | Macon | 10.3 | 187 | | - | 4209 |
| | | | | | | 93732 |
| 35. | (Dooly) | 9.5 | 198 | X | | |
| 36. | (Worth) | 9.4 | 204 | X | | |
| 40. | (Sumter) | 8.2 | 249 | X | | |
| 72. | (Jenkins) | 3.4 | 477 | X | | |
| | | | K E N T U C K Y | | | |
| 1. | Hickman | 15.3 | 84 | X | | 2551 |
| 2. | Fulton | 14.3 | 97 | X | | 3160 |
| | | | | | | 5711 |
| 5. | (Graves) | 4.4 | 407 | X | | |
| 9. | (McCracken) | 3.7 | 455 | X | | |
| 18. | (Ballard) | 2.1 | 590 | X** | | |
| - | (Carlisle) | 0.0 | - | X** | | |

* Research project. Houses not counted in state 1945 total.

** Contingent approval. Emergency flood control project. Houses not counted in state 1945 total.

TABLE X (Con't)

| Rank Order in State | County | Average Annual Death Rate | Rank Order in S.E. States | Extended Malaria Control YES | Extended Malaria Control NO | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | LOUISIANA | | | | |
| 1. | Red River | 22.7 | 28 | X | | 4201 |
| 2. | Morehouse | 18.9 | 50 | X | | 5636 |
| 3. | Bossier | 15.7 | 78 | X | | 6873 |
| 4. | Natchitoches | 15.1 | 86 | X | | 8533 |
| 5. | Madison | 13.0 | 120 | X | | 3351 |
| 6. | West Carroll | 11.4 | 160 | | - | 4751 |
| 7. | Tensas | 11.3 | 161 | | - | 4974 |
| 8. | Jackson | 11.2 | 162 | | - | 3751 |
| 9. | Webster | 10.1 | 188 | | - | 6239 |
| | | | | | | 48309 |
| 11. | (Caddo) | 9.5 | 198 | X | | |
| 17. | (Concordia) | 8.2 | 256 | X* | | |
| 30. | (Catahoula) | 4.1 | 423 | X* | | |
| | | MISSISSIPPI | | | | |
| 1. | Quitman | 33.8 | 6 | X | | 7325 |
| 2. | Humphreys | 26.7 | 18 | X | | 6030 |
| 3. | Bolivar | 21.9 | 32 | X | | 18069 |
| 4. | Coahoma | 20.3 | 40 | X | | 10399 |
| 5. | Sharkey | 19.4 | 45 | X | | 4170 |
| 6. | Leflore | 19.1 | 48 | X | | 10478 |
| 7. | Holmes | 17.6 | 58 | X | | 8186 |
| 8. | Tunica | 15.9 | 77 | X | | 6532 |
| 9. | Tallahatchie | 14.6 | 92 | X | | 9005 |
| 10. | Grenada | 13.6 | 106 | X | | 2982 |
| 11. | Yazoo | 13.0 | 121 | X | | 8065 |
| 12. | Panola | 12.8 | 127 | | - | 8371 |
| 13. | Webster | 12.7 | 132 | | - | 3410 |
| 14. | Warren | 12.6 | 133 | | - | 4243 |
| 15. | Sunflower | 12.1 | 146 | X | | 14485 |
| 16. | Benton | 11.5 | 156 | | - | 2484 |
| 17. | Rankin | 11.5 | 158 | | - | 5890 |
| 18. | Calhoun | 10.5 | 180 | | - | 5090 |
| 19. | Tate | 10.4 | 184 | | - | 4843 |
| 20. | LaFayette | 10.3 | 186 | | - | 4251 |
| | | | | | | 144308 |
| 27. | (Washington) | 8.9 | 228 | X | | |
| | | MISSOURI | | | | |
| 1. | Dunklin | 18.7 | 52 | X | | 8810 |
| 2. | Pemiscot | 17.1 | 64 | X | | 9846 |
| 3. | New Madrid | 11.1 | 163 | X | | 9607 |
| 4. | Ripley | 11.1 | 164 | | - | 3293 |
| 5. | Butler | 10.5 | 179 | | - | 5626 |
| | | | | | | 37182 |

* Contingent approval. Emergency flood control project. Houses not counted in state 1945 total.

TABLE X (Con't)

| Rank Order in State | County | Average Annual Death Rate | Rank Order in S.E. States | Extended Malaria Control YES | Extended Malaria Control NO | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | NORTH CAROLINA | | | | |
| 1. | Craven | 13.4 | 111 | | - | 4423 |
| 2. | Onslow | 12.3 | 139 | | - | 3950 |
| 3. | Beaufort | 11.5 | 155 | X* | | 6589 |
| 4. | Brunswick | 10.5 | 178 | | - | 3817 |
| | | | | | | 18779 |
| 8. | Martin | 6.9 | 289 | X* | | |
| 9. | Bladen | 5.9 | 318 | X* | | |
| 10. | Wayne | 5.5 | 343 | X* | | |
| 13. | Edgecombe | 4.1 | 423 | X* | | |
| 16. | Robeson | 3.9 | 435 | X* | | |
| 20. | Halifax | 3.5 | 470 | X* | | |
| 21. | Johnston | 3.4 | 477 | X* | | |
| 25. | Duplin | 2.5 | 543 | X* | | |
| 26. | Pitt | 2.3 | 562 | X* | | |
| 29. | Northampton | 2.1 | 590 | X* | | |
| 40. | Warren | 0.9 | 789 | X* | | |
| - | Person | 0.0 | - | X* | | |
| | | OKLAHOMA | | | | |
| 1. | McCurtain | 18.9 | 49 | X | | 8960 |
| 2. | Pushmataha | 12.3 | 140 | | - | 4798 |
| | | | | | | 13758 |
| 3. | (Choctaw) | 9.9 | 190 | X | | |
| | | SOUTH CAROLINA | | | | |
| 1. | Colleton | 39.6 | 2 | X | | 5728 |
| 2. | Beaufort | 27.2 | 3 | X | | 4318 |
| 3. | Berkeley | 32.5 | 8 | X | | 5986 |
| 4. | Hampton | 30.9 | 11 | X | | 4420 |
| 5. | Williamsburg | 29.7 | 15 | X | | 7816 |
| 6. | Orangeburg | 26.7 | 17 | X | | 12484 |
| 7. | Calhoun | 23.4 | 24 | X | | 3899 |
| 8. | Allendale | 19.9 | 43 | | - | 3008 |
| 9. | Sumter | 19.1 | 47 | X | | 7577 |
| 10. | Clarendon | 17.8 | 57 | X | | 6518 |
| 11. | Marlboro | 15.0 | 87 | | - | 6531 |
| 12. | Dorchester | 14.0 | 101 | | - | 3836 |
| 13. | Darlington | 12.8 | 124 | | - | 7488 |
| 14. | Jasper | 12.7 | 130 | X | | 2597 |
| 15. | Bamberg | 11.8 | 150 | | - | 3604 |
| | | | | | | 85810 |

* Demonstration projects. Total of 3500 homes comprises state's 1945 total operations.

TABLE X (Con't)

| Rank Order in State | County | Average Annual Death Rate | Rank Order in U.S. States | Extended Malaria Control Yes | Extended Malaria Control No | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | | NORTH CAROLINA | | | |
| 1. | Craven | 13.4 | 111 | | - | 4429 |
| 2. | Onslow | 12.3 | 139 | | - | 3930 |
| 3. | Beaufort | 11.5 | 155 | X | | 8589 |
| 4. | Brunswick | 10.5 | 178 | | - | 3817 |
| | | | | | | 18779 |
| 5. | Martin | 6.9 | 309 | X | | |
| 6. | Tyrrell | 5.9 | 318 | X | | |
| 10. | Jones | 5.5 | 343 | X | | |
| 13. | Edgecombe | 4.1 | 425 | X | | |
| 16. | Robeson | 3.9 | 458 | X | | |
| 20. | Halifax | 3.5 | 470 | X | | |
| 21. | Johnston | 3.4 | 477 | X | | |
| 25. | Duplin | 2.5 | 543 | X | | |
| 26. | Pitt | 2.5 | 552 | X | | |
| 29. | Hertford | 2.1 | 590 | X | | |
| 40. | Warren | 0.9 | 789 | X | | |
| - | Person | 0.0 | - | X | | |
| | | | OKLAHOMA | | | |
| 1. | McCurtain | 18.9 | 49 | X | | 8960 |
| 2. | Pushmataha | 12.3 | 140 | | - | 4758 |
| | | | | | | 13718 |
| 3. | (Choctaw) | 9.9 | 190 | X | | |
| | | | SOUTH CAROLINA | | | |
| 1. | Colleton | 39.6 | 2 | X | | 5725 |
| 2. | Beaufort | 37.2 | 3 | X | | 4319 |
| 3. | Berkeley | 35.5 | 8 | X | | 5986 |
| 4. | Hampton | 30.9 | 11 | X | | 4450 |
| 5. | Williamsburg | 29.7 | 15 | X | | 7816 |
| 6. | Georgetown | 26.7 | 17 | X | | 12484 |
| 7. | Calhoun | 23.4 | 24 | X | | 3899 |
| 8. | Allendale | 19.9 | 43 | | - | 3008 |
| 9. | Sumter | 19.1 | 47 | X | | 7977 |
| 10. | Clarendon | 17.8 | 57 | X | | 6518 |
| 11. | Marlboro | 15.0 | 87 | | - | 6531 |
| 12. | Dorchester | 14.0 | 101 | | - | 3934 |
| 13. | Dertington | 13.8 | 124 | | - | 7438 |
| 14. | Jasper | 13.7 | 130 | X | | 2597 |
| 15. | Bamburg | 11.8 | 160 | | - | 3804 |
| | | | | | | 85310 |

* Demonstration projects. Total of 3500 homes comprises state's 1945 total operations.

TABLE X (Con't)

| Rank Order in State | County | Average Annual Death Rate | Rank Order in S.E. States | Extended Malaria Control YES | Extended Malaria Control NO | Number of Rural Dwellings |
|---|---|---|---|---|---|---|
| | | SOUTH CAROLINA (Con't) | | | | |
| 16. | (Georgetown) | 9.9 | 190 | X | | |
| 20 | (Charleston) | 6.9 | 289 | X | | |
| | | TENNESSEE | | | | |
| 1. | Lauderdale | 16.4 | 73 | X | | 5346 |
| 2. | Lake | 16.0 | 75 | X | | 3271 |
| 3. | Dyer | 14.9 | 88 | X | | 6314 |
| 4. | Haywood | 13.0 | 119 | | - | 5520 |
| | | | | | | 20451 |
| 5. | (Tipton) | 9.3 | 209 | X | | |
| 16. | (Shelby) | 5.0 | 369 | X | | |
| | | TEXAS | | | | |
| 1. | Willacy | 33.3 | 7 | X | | 2392 |
| 2. | Leon | 19.2 | 46 | | - | 4952 |
| 3. | Panola | 18.6 | 53 | | - | 5934 |
| 4. | Robertson | 17.1 | 63 | | - | 6062 |
| 5. | Red River | 15.5 | 82 | X | | 6649 |
| 6. | Sabine | 14.7 | 91 | | - | 2945 |
| 7. | Polk | 14.5 | 94 | | - | 5439 |
| 8. | Starr | 13.5 | 110 | | - | 2713 |
| 9. | San Jacinto | 13.2 | 112 | | - | 2454 |
| 10. | Cherokee | 13.2 | 113 | | - | 8210 |
| 11. | Bowie | 13.1 | 116 | X | | 8684 |
| 12. | Cameron | 13.0 | 118 | X | | 9015 |
| 13. | San Augustine | 12.8 | 128 | | - | 3280 |
| 14. | Hidalgo | 12.4 | 136 | X | | 12831 |
| 15. | Marion | 12.2 | 142 | | - | 2152 |
| 16. | Grimes | 11.8 | 151 | | - | 4272 |
| 17. | Shelby | 11.6 | 154 | | - | 7063 |
| 18. | Anderson | 10.7 | 172 | | - | 6580 |
| | | | | | | 101627 |
| 45. | (Lamar) | 4.8 | 385 | X | | |
| | | DEMONSTRATION PROJECTS | | | | |
| | | VIRGINIA | | | | |
| 6. | Norfolk | 1.1 | 474 | X | | |
| - | New Kent | 0.0 | - | X | | |
| | | ILLINOIS | | | | |
| 6. | Alexander | 2.4 | 552 | X | | |

Medical Division
Malaria Control in War Areas
U. S. Public Health Service
Atlanta, Georgia
July, 1945